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Analysis of Command and Control Battlefield Functions as Performed in the Armored Brigade

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U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

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of the Deputy Chief of Staff for Personnel**

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14. ABSTRACT (<i>Maximum 200 words</i>): The purpose of the research was to document the synchronization required by command and control tasks performed within the armored brigade, to include CS/CSS units. The immediate application of the documentation was to support developers of staff training in two related projects: Battle Staff Training System and Staff Group Trainer. The documentation was also intended to assist with the planning and execution of collective training. The documentation approach was to apply function analysis (FA) techniques for battlefield functions (BFs) in the Command and Control battlefield operating system. Thirteen FAs were developed for the Brigade headquarters and four supporting units: direct support field artillery battalion, engineer battalion, forward support battalion, and air defense artillery battery. The FAs were revised through a formative evaluation process that included internal review and successive external reviews by combat training centers, proponent agencies, and a review council representing potential users of the FAs. The final products include the FAs, a user's guide, and assessment packages for the BFs.					
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FOREWORD

The research described in this report was one of three efforts conducted under U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) project "Innovative Tools and Techniques for Brigade and Below Staff Training (ITTBBST)." The work in this part of ITTBBST is the fifth in a series of ARI projects directed at analyzing the vertical and horizontal synchronization required by combined arms operations. All of the projects have analyzed functions, previously labeled "critical combat functions (CCFs)" and now labeled "battlefield functions (BFs)." The previous projects analyzed all BFs performed by a heavy battalion task force, integration of fire support performed by an armored brigade, integration of fire support at echelons higher than brigade, and a sample of seven BFs performed by an armored brigade. The research in this project analyzed BFs in the Command and Control battlefield operating system with separate coordinated analyses of the armored brigade headquarters and four types of supporting units.

The analyses developed in the project have been used in the development of staff training in related projects within the ITTBBST program. In addition, U.S. Army Training and Doctrine Command (TRADOC) representatives have identified a variety of applications by TRADOC training developers as well as in collective training.


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ANALYSIS OF COMMAND AND CONTROL BATTLEFIELD FUNCTIONS AS PERFORMED IN THE ARMORED BRIGADE

EXECUTIVE SUMMARY

Research Requirement:

Recognizing the Army's need for additional assistance in planning, executing, and assessing staff training, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) initiated a project to develop "Innovative Tools and Techniques for Brigade and Below Staff Training (ITTBBST)." Within this project, the Battle Staff Training System (BSTS) Team developed materials to support training of individual staff, while the Staff Group Trainer (SGT) was developed to support training of various combinations of staff officers and sections. ARI recognized the need to provide a sound basis for development of these staff training modules and asked for a comprehensive analysis of the interconnectivity of specified command and control tasks at the brigade level, to include supporting combat support (CS) and combat service support (CSS) units. This report documents that analysis, the resulting products, and their use both to ITTBBST developers and to other Army constituencies.

Procedure:

The functional analysis methodology (Mullen, 1996) was used to provide a systematic structure and organization for the tasks critical to battlefield success. The methodology was an extension of techniques previously used to document complex functional relationships at the maneuver battalion task force level, and refined through application to selected brigade-level battlefield functions (BFs).

Thirteen BFs were selected for analysis. Three BFs dealing with command and control of forces during the planning, preparation, and execution of battle were analyzed for the armored brigade headquarters, the forward support battalion, the direct support field artillery battalion, and the engineer battalion. One BF dealing with brigade active air defense measures was analyzed for the air defense artillery battery.

The analysts who worked on the armored brigade headquarters BFs had extensive experience with prior BF projects, in addition to their extensive experience as Army leaders and trainers. The analysts for the CS and CSS units had recently completed work on another ARI project where they had developed task-based combined arms training strategies (CATS) for these types of battalions. As part of that project, they received extensive input from representatives of the relevant U.S. Army Training and Doctrine Command (TRADOC) proponent schools, as well as from selected battalion commanders in both U.S. Army Europe (USAREUR) and the continental United States (CONUS). This feedback and their own analyses led to the identification of many staff tasks not present in current doctrinal literature. These tasks, which

were incorporated into the CATS, were included in the BF analyses so that they could be used to develop staff training through BSTS and SGT.

Extensive internal and external reviews of the functional analyses (FAs) were conducted. The internal reviews focused on consistency with related analyses, completeness of outcomes identified, and doctrinal suitability of recommended tactics, techniques, and procedures. There were three formal external reviews:

- Teams of observer/controllers from the National Training Center (NTC) and the Joint Readiness Training Center (JRTC).
- Representatives of the relevant TRADOC proponent schools.
- A Force XXI Review Council.

Findings:

The findings for this project are in the form of products specifically designed to support Army training and training development. The FA documents are divided into 12 sections that provide various graphical representations and verbal explanations of the complex interrelations among tasks within a particular BF and the linkage of those tasks to tasks in other BFs. The project also developed an assessment package for each BF aimed at facilitating the collection of information about unit performance. In addition, a user's guide was developed specifically to assist unit commanders to apply these products to home station training. The products of this project:

- Identify relationships among battlefield operating systems, tasks, echelons, and people required to achieve identified outcomes. This information is essential to identifying appropriate training audiences.
- Provide explicit ties to tasks derived from Army training and evaluation program mission training plans and doctrine, tactics, techniques, and procedures described in doctrinal manuals, applied at combat training centers, identified in lessons learned documents, or identified by experienced field commanders. This representation of procedural steps and tasks that must be accomplished to succeed on the battlefield is the essential foundation for training development.
- Provide guidance for measuring performance and effectiveness based on observable outcomes.

Utilization of Findings:

The FAs provided developers of BSTS and SGT with detailed descriptions of command and control functions at the brigade level, emphasizing the linkages and dependencies among the brigade's maneuver, CS, and CSS elements. The analyses also provided a common framework for designing and implementing performance measurement and After-Action Review techniques. The common framework helped integrate the BSTS and SGT training programs to ensure they were mutually supporting and provided a consistent progression of training from individual, to small group, to full staff.

During the course of the external reviews, TRADOC representatives identified a variety of applications for the products of this study in support of their own training development efforts and in the implementation of collective training programs.

ANALYSIS OF COMMAND AND CONTROL BATTLEFIELD FUNCTIONS AS PERFORMED IN THE ARMORED BRIGADE

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ANALYSIS OF COMMAND AND CONTROL BATTLEFIELD FUNCTIONS AS PERFORMED IN THE ARMORED BRIGADE

Introduction

Background

Given the task-based nature of Army training, the tools for identifying, structuring, and organizing tasks critical for combat effectiveness are essential to realizing goals of Army training for the 21st century. Providing such tools has been a persistent effort in structuring assessment and planning of collective training. Army Training and Evaluation Program Mission Training Plans (ARTEP-MTPs), which list tasks by mission, represent one approach to provide that structure. A complementary approach has emerged in the use of functional areas (Mullen, 1996).

Several initiatives have considered tasks in relation to functional areas rather than missions. One such approach, adopted at the Combat Training Centers (CTCs) in the mid-1970s, used Battlefield Operating Systems (BOSs) as the framework for after action reviews (AARs) and take home packages. The BOSs are seven functional areas which encompass tactical operations.

To enhance the utility of the BOS structure, the U.S. Army Training and Doctrine Command (TRADOC) developed the Blueprint of the Battlefield (U.S. Army TRADOC, 1992). That work used the BOS structure as a framework to describe the tactical level of war in terms of operating systems, functions, and generic tasks. While the functional hierarchy in the Blueprint of the Battlefield provided finer granularity than the BOS, the Blueprint of the Battlefield did not represent battlefield processes, critical sequences of events, procedural steps, and many of the tasks that must be accomplished.

This project is part of an effort to improve further the functional structure for planning and assessing collective training through the identification and analysis of Battlefield Functions (BFs).¹ Like the Blueprint of the Battlefield, the BFs orient on functions (activities and processes that occur over time) while providing granularity that supports task-based training. The BF analyses extend the Blueprint of the Battlefield in two ways:

- They identify relationships among BOSs, tasks, echelons, and people required to achieve identified outcomes, thus improving representation of battlefield processes and sequences of events.
- They provide explicit ties to tasks derived from ARTEP-MTPs and doctrine, tactics, techniques, and procedures described in doctrinal manuals, applied at CTCs, or identified by experienced field commanders, thus improving representation of procedural steps and tasks that must be accomplished.

¹ The term "Battlefield Function (BF)" was designated by the U.S. Army Training and Doctrine Command (TRADOC) in September 1996 to replace "Critical Combat Function (CCF)." At the same time, the term was redefined as "Processes or activities occurring over time that must be performed to accomplish a mission(s) or supporting critical tasks. It provides task integration, combined arms interaction, and inter-Battlefield Operating Systems (BOSs) linkages." Another TRADOC decision was to change the name of the analysis from "Task Analysis" to "Function Analysis."

Various BFs have been analyzed at a level of detail that supports a functional approach to training. The functional approach uses BFs performed by units as the basis for assessing proficiency and planning training. The BF function analyses (FAs) provide content and a framework to apply the functional approach to training. The 39 BFs shown in Table 1 are relevant to tactical operations at echelons from battalion through corps. Association of specific BFs to particular type units indicates that those BFs are germane to the unit's training program. At the start of this project, BF FAs of the 25 BFs that apply to the battalion task force (TF) (e.g., Harrison, 1995; Jarrett, 1995; McIlroy, 1995) had been completed. Work at the brigade, division, corps, and joint task force (JTF) levels was in progress.

Role of BF Function Analyses

The BF FAs are a valuable tool for illuminating procedures at brigade level and ensuring consistency across related training development efforts. They provide a common structure to facilitate the design and implementation of training support packages at multiple echelons. The analysis determines linkages and dependencies across functional elements of a brigade or battalion. The output of the FAs helps define measures of performance based on observable outcomes.

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) supported the extension of the BF FAs within the "Innovative Tools and Techniques for Brigade and Below Staff Training (ITTBBST)" for the Battle Staff Training System (BSTS) and Staff Group Trainer (SGT) projects. That support came in two ways. First, the BF FAs provided developers of BSTS and SGT products with a detailed description of command and control functions at the brigade level, with emphasis on linkages and dependencies among the brigade's maneuver, combat support (CS), and combat service support (CSS) elements. Second, the FAs provided a common framework for designing and implementing performance measurement and AAR techniques. The common framework helped integrate the BSTS and SGT training programs to ensure they were mutually supporting and provided a consistent progression of training from individual, to small group, to full staff.

Table 1

Battalion and Brigade Battlefield Functions Grouped by BOS

BOS	Battlefield Function (BF)	Applies to:	
		Bn	Bde
Intelligence	1. Conduct Intelligence Planning	X	X
	2. Collect Information	X	X
	3. Process Information	X	X
	4. Disseminate Intelligence	X	X
Maneuver	5. Conduct Tactical Movement	X	X
	6. Engage Enemy with Direct Fire and Maneuver	X	
Fire Support	7. Employ Mortars	X	
	8. Employ Field Artillery	X	X
	9. Employ Close Air Support	X	X
	10. Conduct Electronic Collection and Attack		
	11. Conduct PSYOP		
	12. Employ Chemical Weapons ²		
	13. Conduct Counter Target Acquisition Operations		
	14. Employ Naval Surface Fires		X
Air Defense	15. Coordinate, Synchronize, and Integrate Fire Support	X	X
	16. Take Active Air Defense Measures	X	X
	17. Take Passive Air Defense Measures	X	
Command and Control	18. Plan for Combat Operations	X	X
	19. Direct and Lead Unit During the Preparation Phase of the Battle	X	X
	20. Direct and Lead Unit in Execution of Battle	X	X
Mobility and Survivability	21. Overcome Obstacles	X	X
	22. Enhance Movement		
	23. Provide Countermobility	X	X
	24. Enhance Physical Protection	X	X
	25. Provide Operations Security	X	X
	26. Conduct Deception		
	27. Conduct NBC Defense	X	X
Combat Service Support	28. Provide Transport Services	X	X
	29. Conduct Supply Operations	X	X
	30. Provide Personnel Services	X	X
	31. Maintain Weapons Systems and Equipment	X	X
	32. Provide Health Services		X
	33. Treat and Evacuate Battlefield Casualties	X	X
	34. Conduct Enemy Prisoners of War Operations		X
	35. Conduct Law and Order Operations		
	36. Conduct Civil Affairs Operations		
	37. Provide Sustainment Engineering		
	38. Evacuate Non-combatants from Area of Operations		
	39. Provide Field Services		

² Although U.S. National Policy has renounced the use of chemical weapons, BF 12 is retained because the function could be performed by other nations.

Technical Objective

The BF project was designed to meet the first of the three technical objectives contained in the ITTBST statement of work (U.S. Army Research Institute for the Behavioral and Social Sciences, 1995):

To develop and document, in the form of BF function analyses, the interconnectivity of specified command and control tasks at brigade level, to include supporting CS/CSS slice units to serve as the basis for development of staff training modules.

Organization of the BF Research Report

The remainder of this research report contains the following sections:

- **Definition of the Problem.** Describes the problem to be addressed by the BF FAs. Includes a literature review of operations and training doctrinal sources, a summary of related research, and a statement of the problem.
- **BF Product Design.** Identifies the BFs that were analyzed and describes the components of the FAs and key features of the analysis.
- **Development Methodology.** Describes the development of the draft FAs and the auxiliary products--assessment packages and the user's guide.
- **Formative Evaluation (FE).** Describes the internal review process and the external reviews, including participants and issues raised by appropriate Army agencies and commands.
- **Conclusions.** Discusses applications of the BF FAs and future directions to extend the analyses.

Definition of the Problem

The problem addressed by this project concerns the need for materials to support assessment and training of combined arms forces. In this section, the literature review describes the doctrinal background for a functional approach to training and the review of related research summarizes the status of other BF analysis projects.

Literature Review

The need for a functional approach to training is rooted in Army doctrine, specifically FM 100-5, Operations (U.S. Department of the Army, 1993). That publication identifies six fundamentals of Army operations. One of those fundamentals is integration of Army capabilities; one of those capabilities is fighting as a combined arms team:

Combined arms warfare is the simultaneous application of combat, CS, and CSS toward a common goal. *These arms and services are integrated horizontally at each command echelon, normally battalion through corps, and vertically between*

these command echelons. [Italics added] . . . Army forces overwhelm the enemy's ability to react by synchronizing indirect and direct fires from ground and air-based platforms; assaulting with armor, mechanized, air assault, and dismounted units; jamming the enemy's communications; concealing friendly operations with obscurants; and attacking from several directions at once. . . . [The application of combined arms] requires detailed planning and violent execution by *highly trained soldiers and units who have been thoroughly rehearsed.* [Italics added] (U.S. Department of the Army, 1993, page 2-3)

The italicized portions of the extended quotation highlight two criteria of the analysis needed to support combined arms operations:

- Provide specific horizontal and vertical linkages of people and units.
- Support collective training.

In the discussion of another fundamental of Army operations, combat power, FM 100-5 describes a functional approach to managing forces at the tactical level. In this case the functions are the seven BOSs.

A variety of functions help the commander build and sustain combat power. Commanders integrate and coordinate these functions to synchronize battle effects in time, space, and purpose. (U.S. Department of the Army, 1993, page 2-12)

This project added levels to the functions beyond the BOS level and extended the application of functions to collective training.

The Army's primary training doctrine is included in two documents: FM 25-100, Training the Force (U.S. Department of the Army, 1988), establishes the training doctrine; FM 25-101, Battle Focused Training (U.S. Department of the Army, 1990), applies and illustrates the training doctrine at battalion, company, and platoon levels. As the title of FM 25-101 suggests, the thrust of Army guidance is to focus training efforts on tasks that are essential for combat. The intent of the functional approach to training is fully consistent with that thrust and provides tools that facilitate that purpose.

The doctrinal documents acknowledge the potential value of organizing training by functions through the BOSs, but the role of the BOSs is not central:

The BOS are *a* tool and provide *a* process to evaluate and assess performance. They *may* be used to identify operational deficiencies and focus attention for training. . . . They are not an end in themselves. Mission accomplishment and overall unit performance are what count. [Italics added] (U.S. Department of the Army, 1990, page 2-18)

In the context of FM 25-100/101, the BOSs have two suggested roles: As a possible guide during the commander's assessment of Mission Essential Task List (METL) tasks (U.S. Department of the Army, 1990, page 3-16); and as a tool to organize battle tasks (U.S.

Department of the Army, 1990, page 2-18). Battle tasks are subsets of METL tasks for subordinate units which the TF commander will emphasize in subsequent training. Past research suggests that battle tasks have little impact on establishing training priorities for subordinate units, especially CS and CSS units that are task organized to support the maneuver unit. In the ARI project "Determinants of Effective Unit Performance," researchers found formal battle tasks in only three of 14 battalions (Keesling, O'Mara, & Flanigan, 1994) and none of them were organized by BOS. Even if the requirements to identify battle tasks were followed, there is no procedure to ensure that battle tasks for CS and CSS units will be synchronized with tasks for combat maneuver units. Identifying tasks to support the maneuver battalion, for example, is the responsibility of the CS or CSS battalion commander, who is given no guidance beyond the statement that selecting battle tasks is "extremely difficult" (U.S. Department of the Army, 1990, page 2-18). This project provided analyses to ease the difficulty of that process.

Given time, most commanders can identify the tasks required for their unit. The tasks are well documented in field manuals (FMs) and ARTEP-MTPs for each type of unit. While the BF FA procedure did identify tasks that had not been documented, the problem is not a shortage of task documentation. The problem is identifying tasks for staffs and for the variety of units in a combined arms operation, describing the linkages among those tasks and units required to synchronize the functions, and making the information accessible to unit trainers. The next section reviews research efforts to solve the problem.

Review of Related Research

As described in the Introduction, the functional approach to training incorporates analyses of BFs into training assessment and training development. During the ARI project "Research to Design and Develop a Model Training Strategy for a Combined Arms Task Force," 24 FAs were completed for the 25 BFs that relate to the heavy battalion TF.³ Also under this project, researchers developed guidance to battalion commanders on procedures to incorporate the BF FAs in assessment and development of collective training. The guidance implements the functional approach to training within the context of FM 25-100/101 (Harrison, Mullen, Ford, Kemper, & Bartkoski, in press).

Another ARI project-- "Indicators of Readiness"--extended the FAs to develop assessment packages that enable commanders and training managers to assess the status of their units. That work is complete for the BFs required for the heavy battalion TF (Kemper, in press).

Also funded by ARI were three projects that extended the BF analyses for the brigade echelon. In the project "Brigade Level Critical Combat Function (CCF) and Tasks," researchers developed a maneuver brigade FA for BF 15, Coordinate, Synchronize, and Integrate Fire Support (McIlroy, Mullen, Dressel, & Moses, 1996). In a related project, the analysis was extended to include naval and Air Force fire support assets and add the division (Fields, Mullen, & Moses, 1997), corps (Taylor, Mullen, & Moses, 1997), and JTF (Fields, Taylor, Moore, Mullen, & Moses, 1997) echelons. These two projects demonstrate that the BF analytic approach

³At the battalion TF level, it was appropriate to combine the two Air Defense BFs.

is appropriate at the brigade echelon despite the large number of units that can be involved in this very complex function.

The third related BF project is "CCFs for Force XXI Training Program." This project was designed to assess the practicality of BFs for a variety of BOSs: Intelligence, Mobility and Survivability; and Logistics. Seven BFs were analyzed (Bartkoski & Harrison, in press; Huffman and Finley, in press; Jarrett, 1996):

- BF 1: Conduct Intelligence Planning
- BF 2: Collect Information
- BF 3: Process Information
- BF 4: Disseminate Intelligence
- BF 21: Overcome Obstacles
- BF 28: Provide Transport Services
- BF 29: Conduct Supply Operations

Results from the three ARI projects oriented on brigade level BFs validated the BF approaches for the armored brigade and for CS and CSS units that support an armored brigade.

Another ARI project, "Preparation of Validated Training Strategies for Army Battalions" (Keenan, Keesling, & Graney, in press) provided background of performance requirements for the CS and CSS battalions. In that project, military analysts developed Combined Arms Training Strategies (CATS) for 11 types of battalions, including the direct support (DS) field artillery battalion, forward support battalion (FSB), engineer battalion, and air defense battalion. All of the principal analysts for the CS and CSS units in the BF project for ITTBBSST had developed CATS for their respective unit types. The development included coordination with TRADOC proponents and with units. This direct, recent experience with tasks, doctrine, and prerequisites plus the identification of many staff tasks not present in current doctrinal literature were incorporated in the BF FAs for the CS and CSS units of the ITTBBSST program.

The BF FAs have been demonstrated to be effective tools for identifying the horizontal and vertical linkages inherent in combined arms warfare. Previous projects validated the approach at the battalion TF level and for selected BF at brigade and higher levels. The efforts in this project expanded the knowledge base regarding brigade and battalion operations to support the development of enhanced training tools. The design of the products to meet that goal is described in the next section.

BF Product Design

Like all job and task analyses, the content of the BF FAs depends somewhat on the purpose of the analysis. In all applications, BF FAs describe the processes in a combat operation required to fulfill the purpose of the functions. Because the application for the 13 BF FAs in this project is to support training, the FAs emphasize information required for effective training, e.g., tasks, participants, linkages, and required input-output information. This section identifies the

BFs that were analyzed, describes the components of the analyses, and gives a brief overview of the key features of the analyses.

BFs Selected for Analysis

This project provided the analysis necessary to synchronize the brigade BFs developed under the other current ARI projects as well as brigade BFs to be developed in future projects. The technical objective describes the scope of this analysis as "the interconnectivity of specified command and control tasks at brigade level, to include supporting CS/CSS slice units." Achieving that objective required FAs of BFs as performed by five unit types. The unit types were the armored brigade headquarters (HQ), plus three CS units [DS field artillery battalion, engineer battalion and air defense artillery (ADA) battery], and one CSS unit--the FSB. The BFs were the three functions related to the Command and Control BOS for brigade HQ and the supporting battalions, plus BF 16, that addresses command and control for brigade air defense. The combination of unit types and BFs resulted in the following 13 BF FAs:

- BF 18: Plan for Combat Operations--Brigade HQ
- BF 18: Plan for Combat Operations--DS Field Artillery Battalion
- BF 18: Plan for Combat Operations--FSB
- BF 18: Plan for Combat Operations--Engineer Battalion
- BF 19: Direct and Lead Unit During the Preparation Phase of the Battle--Brigade HQ
- BF 19: Direct and Lead Unit During the Preparation Phase of the Battle--DS Field Artillery Battalion
- BF 19: Direct and Lead Unit During the Preparation Phase of the Battle--FSB
- BF 19: Direct and Lead Unit During the Preparation Phase of the Battle--Engineer Battalion
- BF 20: Direct and Lead Unit in Execution of Battle--Brigade HQ
- BF 20: Direct and Lead Unit in Execution of Battle--DS Field Artillery Battalion
- BF 20: Direct and Lead Unit in Execution of Battle--FSB
- BF 20: Direct and Lead Unit in Execution of Battle--Engineer Battalion
- BF 16: Take Active Air Defense Measures--ADA Battery

The approach followed in the analysis of heavy battalion TF BFs (Mullen, 1996) and refined and adapted for the analysis of brigade BFs was applied to these 13 FAs. As will be described in the next section, this approach was well suited to provide the horizontal and vertical linkages required to reflect the complexity of combined arms operations.

Rationale for BF Components

Each BF FA identifies the tasks that must be performed by the commander, staff, key officers and noncommissioned officers (NCOs), subordinate elements, and supporting elements. The FAs give special attention to the coordination tasks required to synchronize and coordinate elements in a combined arms operation. The overriding concern is to portray accurately the interactions of a complex function. The Task List is the primary component for conveying that

information, though other components contribute. Since the purpose of the BF FAs is to support training, information needed to train the tasks in a realistic field environment is included. All of the 12 BF components (described in this section) contribute to that purpose. To clarify the intent of the components, this section describes the components and discusses their evolution.

Preface

Description. Information is provided concerning the presentation of the BF FA components, the table of organization and equipment (TO&E) of the type unit for which the BF FA is relevant, and the context in which the FA was developed. The information provides an overview of the analytical approach used for the FA.

Evolution. The Preface was introduced as an explanatory statement for other analysts with the publication of the battalion TF analyses. A Preface (or "Introduction" in some cases) has been included in all FAs published to date. Analysts recognized early the need to make explicit any assumptions they may have made (for example, whether to include emerging technologies) and to provide information about the nature of the analysis.

Purpose and Outcomes

Description. The overall end result to which the BF is supposed to contribute, termed the purpose, is identified. This component also identifies BF outcomes, the end states of task performance which are necessary to achieve the purpose.

Evolution. The sub-BOS included one outcome for each function, in fact the definition of a sub-BOS was "a function with a distinct outcome and clearly defined processes." During the battalion TF analyses, outcomes were broadened to include critical BF processes. An overall purpose was included to add a more global context. The BF purpose and outcomes are considered to be cornerstones both for identifying tasks and for assessing training.

Flow Charts

Description. This graphical description portrays the sequence of BF tasks within the framework of tactical battle phases (i.e., planning, preparation, execution). This component describes the flow of tasks during each battle phase, the vertical task linkages (to higher and lower echelon units), and horizontal linkages to other BFs for the echelon being analyzed. It also depicts information flow which affects the tasks.

Evolution. The first Flow Chart was a tool that the current brigade coordinator used to display tasks in the prototype FA--Construct Obstacles. He used it for three purposes during the analysis: (a) to determine whether tasks were sequential or concurrent, (b) to identify linkages and (c) to define relationships between tasks as a check on completeness (for example, to be sure that barrier equipment to be installed during execution has been ordered during planning). Flow Charts were subsequently found to be very useful in illustrating the concept of a function since they showed the interrelationships in the process. They have been included in all published BF FAs.

Task Linkages to Other BFs/Units

Description. Tasks performed within other BFs or by other units are described as they relate (i.e., are linked) to the tasks of the BF being analyzed. These descriptions provide verbal details of the relationships portrayed graphically by the Flow Charts. The purpose of this component is to allow the user to incorporate related tasks and participants into a training exercise for this BF. Tasks which link to each FA are extracted for BFs or units for which FAs have been accomplished and extrapolated for FAs which have not yet been developed.

Evolution. This component was included with the battalion TF analyses. Then analysts listed the functions that had an impact on the BF being analyzed and provided a short description of the logic behind the selection. For example the logic for the interaction of BF 4 (Disseminate Intelligence) with BF 23 (Provide Countermobility) was "Receipt of updated enemy intelligence will allow more precise obstacle siting." When Harrison et al. (in press) developed training using FAs, they found that level of information was insufficient to support decisions on whether to add tasks or participants to the scope of a training event. The brigade analyses have much more detail on the interrelationships, making the linkages at the task level rather than at the more global BF level.

Key Participants by Task

Description. All of the participants required to perform the tasks are identified. Identification is based on the appropriate echelon/type unit. It includes special staff members who are critical for task accomplishment. Identifying the participants who are directly or indirectly involved in a task is the key feature of the combined-arms nature of the BFs.

Evolution. A list of key participants was part of the definition of the sub-BOS to the extent that the task titles identified task performers. The purpose was to depart from the "stovepipe" performance of tasks and show the criticality of integrated and coordinated task performance by all key participants (e.g., the logistics personnel who provide material to emplace obstacles.) As the horizontal and vertical linkages were emphasized, the Key Participants component became more detailed and precise. Beginning with the battalion TF analysis phase, the key participants have been listed for each task.

Key Inputs and Outputs

Description. The information a unit needs to accomplish the BF (e.g., paragraphs in the operation order) and information that should be provided to other units are listed. The listing of these inputs and outputs is organized by the document or message source that communicates them. The listed inputs and outputs are pertinent to the echelon and function being analyzed and do not reflect all the information available.

Evolution. This component was included beginning with the battalion TF analyses to identify information needed to start the task and the results of the tasks being performed. The intent was to develop a training support package that included all information that the commander needed to drive

the training event. Because the experience of using the FA to aid in training development reinforced the importance of this information, the level of detail was increased for the brigade analyses. For the brigade FAs, analysts sought to provide enough detail to support designing the conditions for training and assessing performance based on products.

Task List Summary

Description. The tasks which are described in detail in the Task List are summarized and numbered. The numbers allow cross referencing among BF FA components.

Evolution. This component was included with the battalion TF analyses and has continued without change. As the Task List became more detailed, the Task List Summary became increasingly useful as a quick reference to remind the reader of the tasks being analyzed.

Task List

Description. Tasks and supporting tasks necessary to perform the function are listed by battle phase. Normally, each task identifies the primary participants responsible for its performance. The tasks have been extracted from the appropriate ARTEP-MTPs, echelon and functional area FMs, and proponent school special texts. When there are gaps in the documentation of procedures, the analysts provide further detail based on lessons learned and personal experience. The specific sources or references for each task and supporting task are shown following the task or supporting task. The references facilitate review of original source material for further detail and context.

Evolution. This component has always had the highest visibility, which is justifiable since the Task List is the crux of the analysis. The component has evolved to include more detail and more precise references. The change in level of detail from sub-BOS to battalion TF was significant. The sub-BOS rarely had more than two levels of supporting tasks; some battalion TF analyses had as many as six levels. Determining the appropriate level of detail involved trade-offs among project resources and user acceptability. At the start of the brigade analyses, the MTPs were made available in a digital format which reduced the costs of adding further detail. Still, there was a concern that the level of detail in a paper-based product would inhibit the usefulness of the documents. At that time, however, the sponsors and monitors of the development work established the goal of working toward incorporating the analyses into a relational database rather than publishing them as books. In that format, excessive detail is not a problem since users control the information presented to them. As a result of these two factors, the increase in detail between the battalion TF analyses and brigade level analyses was even more dramatic than the increase between sub-BOS and battalion TF.

The increase in level of detail also made it desirable to document the sources of supporting tasks as well as tasks. That documentation was added with the brigade analyses. In addition to published sources, the references identify supporting tasks derived from formative evaluation reviews [such as comments by National Training Center (NTC) observer/controllers (O/Cs)] or the analyst's experience.

Tasks Organized by Outcomes

Description. Tasks and supporting tasks necessary to perform the function are listed by outcome. The component supports analysis of performance related to outcomes to identify tasks for sustainment or remediation training.

Evolution. The first mapping of tasks to outcomes was performed to support development of assessment packages based on the battalion TF analyses. One result of that process was the realization that making the linkages between tasks and outcomes explicit provided an excellent indicator of the completeness of the analysis. Harrison et al. (in press) found the tasks organized in that way to be useful in planning training. The rationale for adding the linkages as a component was that it facilitated internal review of the FA and enhanced the value of the FA as a training support package. The component was first included under ARI project "CCF for Force XXI Training Program."

Lessons Learned

Description. The lessons learned extracted from the Center for Army Lessons Learned (CALL) publications relevant to performing a given BF are identified. They are organized and listed by the appropriate task from the Task List component. The purpose of this component is to provide the user with recent tactics, techniques, and procedures (TTP) associated with the performance of the tasks in a BF.

Evolution. The primary rationale for this component was also related to the goal of enhancing an FA's value in supporting training. The lessons learned, extracted from CALL publications, were viewed as a mentoring aid that provided commanders with useful information to supplement the MTPs regarding conditions under which tasks are performed and details for performing them. The inclusion of lessons learned also helped to keep the analyses current. In the battalion TF analyses, extracts from CALL bulletins were presented organized both by bulletin and by task. When the battalion TF analyses were used to develop training, the information was found to be useful, but the format was cumbersome and redundant. For the brigade analyses, the information is presented in the context of the Task List and highlighted in this component.

Gate Tasks

Description. Critical individual or collective tasks which participants must be able to perform prior to engaging in the identified BF tasks are listed so that the training can be conducted efficiently and safely.

Evolution. The battalion TF analyses included a component called Critical Tasks and Other Linkages, which identified implied subordinate individual or collective tasks, but task titles and numbers documenting the tasks were not provided systematically. Two factors resulted in increased emphasis on prerequisite tasks. The level of detail was found to be insufficient guidance for developing a training program. That conclusion was reinforced by experience developing CATS, which showed the value of

an authoritative identification of training prerequisites at the task level. The Gate Tasks component, with much more consistent references to documentation, was therefore added to the brigade analyses.

References

Description. The references and sources used by the analyst are identified.

Evolution. The Reference component was included with the battalion TF analyses and has been part of all subsequent analyses.

Key Features of Analyses

Although the FAs in this project were similar to analyses in related projects, these analyses include several unique features based on the complexity of command and control at the brigade level and emerging trends for Army doctrine. The following six characteristics are particularly significant:

- Recognize that planning is continuous and must occur while the brigade is conducting current operations concurrent with the planning for future operations.
- Ensure consonance with the emerging military decision-making process (MDMP).
- Define one approach for parallel planning to occur between the brigade and its supporting units.
- Address commander tasks.
- Focus on commander and staff tasks required to continually update estimates, make decisions, and synchronize all BOSs during preparation and execution.
- Identify staff tasks to describe the relationship among the battle staff to acquire, process, and apply information.

The methodology to incorporate these characteristics for the 13 BFs required in this project is described in the next section.

Development Methodology

This section describes the procedures to develop each type of product that came out of this project:

- Development of the initial coordinating drafts that were the starting points for FE.
- Development of assessment packages.
- Development of user's guide.

Development of each product will be addressed in a subsection, followed by lessons learned related to the development procedures.

Development of Initial Coordinating Draft FAs

The procedures for developing the BF FAs drew heavily on the subject matter expertise and experience of the BF analysts. This subsection describes the experience of the analysts, the workshop that oriented them to the project, and the procedures followed to produce the FAs.

Selection of Analysts

The principal analyst for each unit type had command experience in the relevant type of unit. Table 2 gives an overview of the experience of the analysts and integrators for FA development.

Table 2

Background of BF Analysts

Position	Background
Project Director, Senior Military Advisor	Retired from the U.S. Army in the rank of brigadier general. An infantry officer with command assignments including TRADOC's Combined Arms Training Activity and a separate armored brigade stationed in Germany. Staff assignments included those at battalion, brigade, division, and unified command levels as well as at the Department of the Army.
Principal Analyst for Brigade BF 18 and BF 20; Brigade Integrator	Retired from the U.S. Army in the rank of colonel. An armor and cavalry officer with extensive troop experience including command of an armor brigade and Director of CALL.
Principal Analyst for Brigade BF 19	Retired from the U.S. Army in the rank of colonel. A field artillery officer with extensive troop experience including command of a DIVARTY during Desert Storm and Director of Training at the U.S. Army FA School (USAFAS).
Principal Analyst for Engineer Battalion	Retired from the U.S. Army in the rank of colonel. An engineer officer with extensive troop experience including command of an engineer group (equivalent to a brigade) in Korea and command of an engineer battalion.
Principal Analyst for DS Field Artillery Battalion	Retired from the U.S. Army in the rank of colonel. A field artillery officer with extensive troop experience including command of a field artillery brigade and president/commander of the U.S. Army Field Artillery Board.
Principal Analyst for FSB	Retired from the U.S. Army in the rank of colonel. A logistics officer with extensive troop experience including command of an FSB, command of a division support command, and staff assignments as G4 of a division and a corps.
Principal Analyst for ADA Battery	Retired from the U.S. Army in the rank of colonel. An air defense officer with extensive troop experience including command of an air defense battalion and three batteries and Director of Training Developments at the U.S. Army Air Defense Artillery School (USAADAS).
Battalion TF Integrator	An infantry officer with extensive troop experience culminating in assignment as an O/C at the NTC while on active duty in the U.S. Army. Experience also includes that of a battalion S3 and executive officer (XO) in the U.S. Army Reserves.

Analyst Workshop

The BF Team conducted a workshop for BF analysts at the beginning of the project. The workshop oriented the analysis staff to the functional approach and trained analysts in the FA methodology. The orientation focused on the functional approach and the specification of the links across staff and across units required to achieve the outcomes of the function. The instruction gave particular attention to requirements stemming from the related BSTS and SGT projects. The workshop also established procedures for communication among the analysts, who typically worked from remote sites, in what was a “virtual” organization.

The emphasis in the workshop was to train the analysis staff as to the level of detail needed in the FA, the various components of the FA, and the expected coordination of efforts required to develop the FA and submit it for the formative evaluation (FE) reviews. The outcome of the workshop was an established focus for each of the FAs. The focus included the Purpose and Outcomes of the BF and the tasks to be addressed. The intended approach was to develop the Purpose and Outcomes for the brigade and later have battalion/battery analysts extend the results to the supporting units.

Purpose and outcomes. The intent of the workshop was to establish the purpose and identify outcomes that would guide subsequent analysis of the FAs, including development of the assessment packages. The goal was a set of outcomes that were compatible with the battalion TF outcomes and consistent across echelons and unit types addressed in this project. Unfortunately, the outcomes established during the workshop were not stable throughout the development. It is not clear whether the fault lay with the quality of the outcomes or the ability of the analysts to coordinate changes to the outcomes. At any rate, the outcomes diverged among the battalion types during development and were not coordinated until the review of the initial assessment packages made the implications of the divergence apparent. The particular problem was that the MDMP (which also shifted during the development phase) was not represented similarly in all analyses. The divergence was remedied during the preparation of the final drafts of the FAs. The final sets of purpose and outcomes of the brigade HQ analyses are shown in Tables 3 through 5.

Table 3

Purpose and Outcomes of Brigade HQ BF 18

<p><u>PURPOSE</u></p> <p>To provide direction and guidance to all elements of the brigade in the form of brigade orders.</p>	<p><u>OUTCOMES</u></p> <ol style="list-style-type: none">1. Complete, concise, feasible, suitable, acceptable, and tactically sound brigade orders that conform to doctrinal standards are issued.2. Brigade orders are received in no more than 1/3 of the available time and understood by key participants and subordinates.3. Sufficient hard copies of the brigade order and all key accompanying documents are provided to key personnel in accordance with tactical standing operating procedures (TSOP).4. Brigade operations, command, and control continue during planning process.
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Table 4

Purpose and Outcomes of Brigade HQ BF 19

<p><u>PURPOSE</u></p> <p>To provide command, leadership, and control of the brigade during the preparation phase to set the conditions to accomplish the brigade mission within the division and corps commanders' intents.</p>	<p><u>OUTCOMES</u></p> <ol style="list-style-type: none"> 1. Brigade command posts (CPs) maintain continuous communications with higher, adjacent, and subordinate headquarters. 2. The brigade commander, staff, and other key individuals within the armored brigade receive, evaluate and process timely and accurate information on the adherence to timelines and quality of battle preparation. 3. Tactically sound recommendations are developed and critical information is communicated by the armored brigade staff. 4. Sound (feasible, suitable, acceptable) decisions are made by the brigade commander and others within the armored brigade. 5. Affected units and personnel receive relevant changes and refinements to plans in time to perform troop leading procedures and required actions. 6. Subordinate leaders demonstrate an understanding of the critical elements of their own mission and mission essential tasks, the brigade mission, and the brigade commander's intent. 7. Soldiers and units are disciplined and motivated to accomplish the mission. 8. The brigade commander exercises command and control to ensure the brigade is prepared to execute the mission.
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Table 5

Purpose and Outcomes for Brigade HQ BF 20

<u>PURPOSE</u>	<u>OUTCOMES</u>
<p>To accomplish the brigade's assigned mission within the division and corps commanders' intents.</p>	<ol style="list-style-type: none"> 1. Brigade CPs maintain continuous communications with higher, adjacent, and subordinate headquarters. 2. The brigade commander, staff, and other key individuals within the armored brigade receive, evaluate, and process timely and accurate battlefield information. 3. Tactically sound recommendations are developed and critical information is communicated by the armored brigade staff and others within the brigade. 4. Sound (feasible, suitable, acceptable) decisions are made by the brigade commander and others within the armored brigade. 5. Affected units and personnel receive relevant direction, changes, and refinements to the plan in time to perform troop leading procedures and execute coordinated and synchronized actions. 6. The brigade staff insures that the brigade commander's guidance and orders are executed and that all relevant actions are coordinated with higher, adjacent and subordinate headquarters. 7. Subordinate leaders demonstrate an understanding of the critical elements of their own mission and mission essential tasks, the brigade mission, and the brigade commander's intent. 8. Soldiers and units are motivated, disciplined, and maintain unit cohesion. 9. The brigade command and control capability is effective, survives, and is prepared for the next mission.

Tasks for brigade HQ. The tasks identified for the brigade HQ FAs during the workshop did not change during the development phase. The tasks for BF 18, Plan for Combat Operations, were based on the steps of the decision-making process with the addition of a task to emphasize the need to continue to monitor and direct current operations while planning for a future operation. The tasks for BF 18 at the brigade HQ level are listed in Table 6.

Table 6

Tasks for Brigade HQ BF 18

- | |
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| <ol style="list-style-type: none"> 1. The brigade commander and staff direct and lead the brigade during planning for the battle. 2. The brigade receives an order initiating a new mission from higher headquarters. 3. The brigade commander and staff conduct mission analysis. 4. The brigade executive officer directs the staff in the preparation and issuance of a brigade warning order. 5. The brigade commander issues initial planning guidance. 6. The brigade commander and staff prepare estimates. 7. The brigade commander and staff develop course(s) of action. 8. The brigade commander and staff analyze course(s) of action. 9. The brigade staff compares course(s) of action. 10. The brigade commander announces decision. 11. The brigade staff prepares the operation order. 12. The brigade commander and staff issue the operation order. |
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Identification of the tasks for the preparation and execution phases was a problem, since the combination of staff and commander tasks is rarely addressed in Army doctrinal publications. The final decision was to base the tasks for BF 19 (Direct and Lead Unit During the Preparation Phase of the Battle) and BF 20 (Direct and Lead Unit in Execution of Battle) on the Blueprint of the Battlefield (U.S. Army TRADOC, 1992). Those tasks are listed in Table 7 and Table 8.

Table 7

Tasks for Brigade HQ BF 19

1. The brigade command posts and staff manage and maintain command, control, and communications.
2. The brigade command posts and staff support synchronization by acquiring, evaluating, and communicating information and maintaining status.
3. The brigade commander visualizes the battlefield.
4. The brigade commander directs changes to the operation or plan.
5. The brigade commander directs and leads subordinate forces.

Table 8

Tasks for Brigade HQ BF 20

1. The brigade commander directs and leads subordinate forces.
2. Brigade command posts support synchronization by acquiring, evaluating, and communicating information.
3. The brigade commander sees and visualizes the battlefield.
4. The brigade commander directs changes to the operation or plan.
5. Brigade command posts manage and maintain command, control, and communications.
6. The brigade consolidates and reorganizes.

Development Procedures

The procedure for preparing the FA initial coordinating drafts included 12 steps, tied to the components of an FA described in Rationale for BF Components. The steps are described below in the sequence in which they were performed.

- Establish the purpose and outcomes of the BF. As described earlier, the purpose and outcomes for the BFs as performed by supporting battalions and the ADA battery were to parallel the purpose and outcomes of the BFs as performed by the brigade HQ.

- Identify the tasks that support the outcomes. This list of critical tasks was developed during the workshop. The tasks were extracted from ARTEP-MTPs and the Blueprint of the Battlefield.
- Identify supporting tasks and processes necessary for the pertinent echelon to achieve the BF outcomes. The identification of supporting tasks was based on a review of doctrinal literature. Preferred sources of these tasks were ARTEP-MTPs; however, analysts were not constrained by the possible limitations of the MTP in developing BF task lists. Additional sources were FMs, special texts, and analysts' field experience directly relevant to the BFs and unit types. Related analysis projects also provided information on supporting tasks. The "living tasks" identified by staff members working on the ARI project "Combined Arms Operations at Brigade Level, Realistically Achieved Through Simulation (COBRAS)" were considered for all analyses. Analysts also coordinated analyses with analysts working on the ARI project "CCFs for Force XXI Training Program."
- Identify the principal participants by position or unit that are directly involved in accomplishing each task.
- Identify the information and guidance required to be furnished to the pertinent unit from higher, lower, and adjacent elements. Also identify information that the unit must develop and furnish so other elements can perform the tasks required to accomplish the function. This step included specifying the products that are used to transmit the information.
- Describe procedures to monitor, plan, and direct combat operations. The procedures include obtaining information the staff needs, processing the information, disseminating information required by others, and ensuring that the commander receives relevant information. The commander directs subordinate units in execution of the mission.
- Identify at task level each of the other BFs which influences, or is influenced by, the Command and Control BFs and BF 16 for the ADA battery.
- Identify lessons learned contained in CALL publications relevant to the Command and Control BFs for the pertinent unit type and BF 16 for the ADA battery. One analyst performed this step for all the BFs.
- Identify significant individual and collective proficiencies which enable the accomplishment of the critical tasks. These constitute the Gate Tasks component of the FA. Analysts derived the gate tasks from MTPs and Soldier's Manuals and from analyses for CATS. In addition, developers from BSTS provided prerequisite tasks related to the battle staff.
- Develop a flow chart that describes the sequence of the tasks and supporting tasks and their relationships: inter- and intra-echelon; and inter- and intra-BOS. The Flow Charts component includes relations to other units and to other BFs.
- List tasks by outcome. Since the immediate purpose of linking tasks to outcomes was to support development of the assessment packages, the process is described more fully in the next subsection.
- List all references.

Development of Assessment Packages

As described in the Review of Related Research, early ARI research on BFs recognized the benefits of an assessment tool to aid commanders in determining the status of their units. Based on the analyses from the project "Research to Design and Develop a Model Training Strategy for a Combined Arms Task Force," ARI requested BF-based assessment packages.

The development of assessment packages was an integral part of the development of brigade-level BFs in this project. They were conceived to serve the same purposes and have the same types of content as those developed for battalion TF BFs. The process of development was to be similar, applying lessons learned in the battalion TF effort.

This section describes the following:

- The purposes envisioned for the brigade-level assessment packages.
- The desired characteristics of the assessment packages.
- The content of the assessment packages.
- The developmental process employed in creating the assessment packages.

Purposes of Assessment Packages

The assessment packages were developed to facilitate the assessment of training at home station and at the CTCs. The following paragraphs describe how the packages can be used to achieve that purpose.

Home station uses. Unit commanders use the Army's Training Management Cycle (FM 25-100) to manage unit training. The assessment packages may be used at each stage of this cycle:

1) They may serve as an aid to the commander who is trying to judge the status of his unit at the start of the training management cycle. A commander who has used the assessment packages in prior exercises should have a clear idea of his unit's training status. A newly-assigned commander could use the assessment packages as the basis for making inquiries about unit training status with his subordinate commanders and staff. If they have used the assessment packages in prior exercises, there should be a sound basis for the commander to make his assessment of training status.

2) They may serve as a guide for the information to be gathered during home station training exercises to determine whether the training has been effective in bringing a unit up to the level of proficiency the commander desires. The emphasis here is on diagnosing weaknesses in performance so that efficient and effective retraining activities may be developed. The assessment packages facilitate the identification of personnel and tasks most in need of retraining; thus, retraining activities can be focused to conserve resources and time.

3) By comparing unit performance to a prior baseline, the assessment packages could also be used to document particularly successful TTP that the unit may have developed, or to identify effective training activities.

CTC uses. The primary mission of the CTCs is to provide feedback to units about their performance under highly realistic and demanding conditions. Using the BF-based assessment packages to standardize the information provided to the training units would allow those units to compare their self-assessments (typically made under less demanding conditions) to the CTC's assessments as a check on their understanding of what is required to accomplish a particular mission. Explicit standardized criteria, such as those included in the assessment packages, would help commanders extend CTC lessons to their home station training programs.

The assessment packages also have potential value for training newly assigned O/Cs. That application would be especially valuable for staff level O/Cs.

The secondary mission of the CTCs is to provide information to the Army leadership about the performance of units. The assessment packages could be used to identify particularly effective TTP employed by the training units. These could be distributed to the Army through the Lessons Learned publications. Using standardized assessments, gathered over time, the Army could evaluate the effects of changes to Army doctrine, organization, training, materiel, leadership, or soldier quality. The BF structure (BOS, BF, outcome, task) could be used to organize the data collected.

Desired Characteristics of the Assessment Packages

There were two competing considerations in developing the assessment packages:

- Making each assessment package comprehensive (including relevant measures and tasks).
- Minimizing the burden on the observers collecting the data and the commanders interpreting it.

The resolution of these competing interests was to develop a system that does not require every task element to be rated at each training event. The primary purpose for these packages at home stations is to identify weaknesses so that training resources may be devoted to improving the performance of the unit. Consequently, the assessment packages are laid out in "levels" of increasing specificity so that if a unit performs adequately at a higher level (e.g., outcome), effort may be saved by omitting assessments at lower levels. In order of increasing specificity the levels are: the purpose, the outcome assessments, and the diagnostic aid subsections. Generally, if a unit is able to attain the purpose, then it will not be necessary for the observer to record assessments of each outcome. Similarly, if a unit accomplishes a particular outcome (whether or not the overall purpose is achieved), the more detailed diagnostic step may be omitted.

Wherever there is a weakness in the performance with respect to a particular outcome the observer should make use of the diagnostic subsection to provide more detailed information to the

commander about the nature of the problem. This will assist the commander in developing a precise remediation strategy so that the unit may be brought to an appropriate level of performance.

Because commanders may focus training on a particular outcome, group of tasks, or grouping of personnel, there is no requirement to use the entire assessment package for each exercise. The commander should select those elements of the assessment package that most closely reflect the focus of the training and instruct the observers to use those elements for providing feedback to the group of trainees and to the commander himself.

In order to be responsive to the requirement for more standardized measures, each assessment package also contains a section of measures of effectiveness. Most of these measures are tied to observable or measurable events on the battlefield (e.g., were templates and matrices updated to be current; how much time elapsed from the issuance of an operations order to the initiation of the action). The measures of effectiveness are to be used in all cases where the training exercise covers the appropriate content. In some cases an exercise may be focused on a particular outcome or a particular group of personnel (e.g., the battalion staff, or a subordinate unit), and only some of the measures of effectiveness would be appropriate.

Content of the Assessment Packages

The assessment packages have five major sections:

- Statement of purpose
- Measures of effectiveness
- Assessment strategy
- Outcome assessment
- Diagnostic aid

Each of these sections is described in more detail in the following paragraphs.

Statement of purpose. This is the purpose of the BF, the end state that particular function is to achieve. The primary question that must be addressed after each mission is, "Did the unit achieve the purpose?" This section asks for a brief synopsis of the intent(s) of the higher commander(s) and a simple yes or no indication of whether the unit achieved the purpose. In addition, if the unit's performance was particularly good, this section provides a place for the observer to record, for possible dissemination to other Army units, the TTP the unit employed.

Measures of effectiveness. This section of the assessment package contains tables and checklists that may be used to record objective, sometimes quantitative measures. These measures are oriented to events on the battlefield. Examples are: whether the staff recognizes when the situation has changed, whether the commander selected a tactically sound course of action, what happened if a key leader was rendered combat ineffective. Table 9 shows the content of these sections for each brigade BF. The assessment package for each supporting

battalion or battery (FSB, engineer battalion, DS field artillery battalion, ADA battery) is tailored to represent its structure and functions, while addressing the same general aspects of performance.

Table 9

Content of Measures of Effectiveness by Brigade HQ BF

Content of Measures of Effectiveness	BF 18	BF 19	BF 20
Operation and monitoring of communication nets	N/A	X	X
Communication of critical information	X	X	X
Updating of operations products	N/A	X	X
Participation in rehearsals	N/A	X	N/A
Location of leaders, succession plan	N/A	N/A	X
Evaluation of tactical situation by commander and staff	X	X	X
Tactical decision-making	X	X	X
Time management (e.g., orders preparation/dissemination)	X	X	X
Commander's leadership	N/A	X	X
Planning process	X	N/A	N/A
Integration, coordination, and synchronization	X	X	X
OPORD briefing	X	N/A	N/A
Confirmation briefings	X	N/A	N/A

Assessment strategy. This section of the assessment package indicates when and where the observer is most likely to find the information needed to make a particular assessment. This section is a job aid for the personnel managing the exercise, allowing them to allocate observers to monitor the key locations, events, products and personnel.

Outcome assessment. Each outcome is addressed in two subsections: an overall assessment and a diagnostic aid (discussed below). The first subsection includes assessment statements to orient the observer to observable performances related to the tasks underlying the outcome. In some cases the performance of a particular outcome has been broken down into components, each of which is assessed separately; for example, gathering information is separated from updating operations templates and matrices. In all cases, the assessment statements are

anchored to tasks and supporting tasks from the FA. Each assessment is to be made using the following rating scale:

ADEQUATE	MARGINAL	NOT ADEQUATE
The unit can successfully accomplish the outcome to standard. Outcome accomplishment is free of significant shortcomings.	The unit can successfully accomplish the outcome with some shortcomings.	The unit cannot accomplish the outcome to standard.

Diagnostic aid. For each outcome, the second subsection facilitates detailed diagnosis of any problems in performance with respect to this outcome. The most important tasks are given in more detail so that the observer may note those that are particularly deficient. (Or, he may highlight those that are exemplary to document a particularly effective TTP.) These tasks are extracted from the Task List and include the doctrinal references so the observer and unit can locate and review the Army's performance standards.

Development Process

Drawing on previous experience, the team developing brigade BFs determined that an assessment package for each BF could be developed using the process that was used to develop battalion TF BF assessment packages (Kemper, in press). That process involved the critical step of aligning tasks to the outcomes supporting the achievement of the purpose. In the development of the battalion TF BF assessment packages, this step was performed by analysts drawn from among those who developed the FAs in a separate project, subsequent to the development of the FAs. Performing the step of linking tasks to outcomes for the battalion effort revealed that some outcomes were not supported by tasks in the Task List component of the FA. The lesson learned was that it seemed more logical to have the task-to-outcome linkage developed by the person developing the task analysis, operating under the guidance that each outcome should have supporting tasks.

For the brigade-level assessment packages, each analyst developing an FA also developed the component linking tasks to outcomes. Ideally, the outcomes would be the focus for identifying tasks to be performed. The completed Tasks Organized by Outcomes component was to be the basis for development of the assessment packages. It was felt that the guidance described above would result in FAs and task-to-outcome linkages that would not have as many missing tasks or faulty linkages as were found in the development of TF assessment packages.⁴ With these problems minimized, it was felt that the development of assessment packages could be expedited.

⁴ The review of task analyses and task to outcome documentation in the battalion TF BF project resulted in the publication of amended task analyses, identifying many additional tasks.

The anticipated strategy was not successful. The Tasks Organized by Outcomes components varied in utility--some analysts indicated that each outcome required all of the tasks (thus vitiating the purpose of the analysis), while other analysts chose to align each task exclusively to one outcome. In addition, as described in the section on the workshop, outcomes were not consistent across echelons and unit types. When the outcomes were revised to achieve the necessary consistency, even the most carefully developed task-to-outcome linkages became irrelevant. In retrospect, the initial training did not give analysts sufficient guidance on the purpose, desired characteristics, and importance of the Tasks Organized by Outcomes component. As a result, contractor subject matter experts (SMEs) who had not been deeply involved in the analysis developed the final Tasks Organized by Outcomes components and helped develop the assessment packages based on the revised outcomes.

Development of the User's Guide

Purpose of the User's Guide

The ARI project "Research to Design and Develop a Model Training Strategy for a Combined Arms Task Force," included guidance for incorporating the BF FAs in assessment and development of collective training (Harrison et al., in press). The Design Document for the current project called for a similar, stand alone, document addressed to commanders of armored brigades. During the early stages of the project, however, analysts who were also working on brigade-level BFs as part of ARI project "CCF for Force XXI Training Program" were authorized to initiate the development of a user's guide for that project, and then to refine it for this project and incorporate it into the current research.

The primary purpose of the user's guide is to illustrate to unit commanders and TRADOC training analysts how to use FA components to implement the functional approach to training within the context of FM 25-100/101. The FA components provide information on the following pertinent topics:

- What are the objectives/missions of the system? (Purpose and Outcomes)
- What are the vertical and horizontal linkages between elements, and what are the information inputs and outputs associated with these? (Flow Charts, Tasks Linked to Other BFs/Units, and Key Inputs and Outputs)
- What are the processes and tasks being performed within each element? (Task List, Tasks Organized by Outcomes, and Flow Charts)
- Who are the players and/or target audience? (Key Participants by Task)
- What enabling knowledge and skills are required? (Gate Tasks)
- Are there any experiences and lessons learned that would be helpful? (Task List and Lessons Learned Integrated into the Task List)

A secondary purpose of the user's guide is to suggest uses of FA components for other audiences. Those audiences include force developers, materiel developers, and doctrine developers.

Content of the User's Guide

The User's Guide includes two sections that provide an overview of BF FAs. The first section describes the background of the functional approach to training and the role of BFs. The second section gives an orientation to the components of the FAs. The remainder of the user's guide describes how to apply information available in the FAs. Most of the guidance is addressed to two audiences: unit commanders and training developers.

Unit commanders. The major thrust of the user's guide is to illustrate the use of the FA components to unit commanders. The general approach is to describe how the components support an aspect of the training and assessment process described in FM 25-100/101 and to illustrate the application of the FA using examples drawn from BF 18 as performed by an armored brigade. The guidance addresses two tasks performed by unit commanders: conduct training assessment and plan training events.

Guidance for unit commanders was developed by identifying information in each component that would support decisions on training by commanders and staff members. The conduct of training assessment is supported by the Purpose and Outcomes. The user's guide illustrates how information from that component could be applied by presenting an assessment worksheet. The worksheet guides an assessment that is tied to METL tasks and proceeds from BOS to BF to outcome. At each level, the commander rates effectiveness as trained, needs practice, or untrained. For the outcomes, the worksheet includes hypothetical assessment comments tied to the Task List.

The User's Guide illustrates how the FAs assist with four steps involved in planning training events:

- Selecting tasks and supporting tasks to be trained. The FAs help with the selection of tasks either by outcome or by battle phase. The User's Guide illustrates the use of the Tasks by Outcomes component with a figure that shows the relation between the tasks and outcomes in brigade HQ BF 18. To show how the FAs help with the selection of supporting tasks, the User's Guide includes an extract from the Task List that shows two levels of supporting tasks related to one of the tasks (which is the basis for all subsequent illustrations related to planning training events). The user's guide then describes how the commander can get more detail by consulting the references cited in the Task List, with further detail in the References component. The User's Guide also discusses the possible relevance of lessons learned and presents an extract from the Lessons Learned component.
- Selecting the training audience. The User's Guide presents an extract from the Key Participants by Task component.
- Identifying task training sequences and products to support training. The User's Guide discusses the uses of the Flow Charts component, and presents an extract from the Key Inputs and Outputs component.

- Determining prerequisite training tasks. The User's Guide presents an extract from the Gate Tasks component that shows prerequisite tasks that could be addressed in staff training, officer development, NCO development, or subordinate unit collective training.

Training developers. The User's Guide also illustrates potential uses of FA components by training developers in TRADOC service schools. Those uses relate to the following: (a) incorporating the materials in TRADOC's computerized software system--Standard Army Training System--for automating training management; (b) development of training support packages; (c) development of training aids, devices, simulators, and simulations; (d) aggregating feedback in the standard AAR system; and (e) inclusion of FA components in the Army Training Digital Library.

Lessons Learned from Development

The BF analysis procedures have been refined over several years to increase their efficiency and effectiveness. As described in the section on BF Product Design, this project benefited from experience in three previous projects. Generally the procedures were effective. The experience in this project, however, suggests further refinements.

This project was the first time that a BF analyst workshop was conducted. The workshop was beneficial, but could have been improved with increased rigor, especially concerning development of the outcomes. Future workshops should increase the checks on consistency with other efforts and conduct a detailed review of workshop outputs (e.g., outcomes) that includes proponents and the Contracting Officer's Representative (COR)/Assistant Contracting Officer's Representative (ACOR). Once there is agreement that the outputs are appropriate, they should not be changed unless there is a major change in doctrine.

Most of the previous BF analysis projects have been limited to one unit type and echelon. This project, like one other BF project, considered multiple echelons and unit types. The other project included naval and Air Force fire support assets and addressed the division (Fields et al., 1997), corps (Taylor et al., 1997), and Joint Task Force (JTF) echelons (Fields et al., 1997). The current project benefited from working with supporting unit types concurrently with analyzing the functions for the brigade HQ. The variety of perspectives from analysts with different backgrounds and officers at different proponent agencies improved the description of integration tasks. Future analyses of brigade level BFs ought to include the investigation of all contributors' roles and participation by the proponents for the various types of units that contribute to the combined arms.

One of the challenges inherent in the process of analyzing a BF is to keep current with changes in doctrine and documentation of that doctrine. While the frequent contact with proponent agencies enabled analysts to respond eventually to changes, the analysts were hampered in some cases by outdated publications--for example, TRADOC Pamphlet 11-9 (Blueprint of the Battlefield) and FM 44-8 (Small Unit Self-Defense Against Air Attack).

Analysts in future similar projects would benefit if they or the COR/ACOR is on the distribution list for draft and final publications and analysts have access to a library of current documents.

Experience in this project confirms the importance of close ties between analysts and proponent agencies. In this case, informal discussions between the principal brigade HQ BF 18 analyst and Fort Leavenworth proponents identified changes to emerging doctrine related to the MDMP. For all unit types, the ground work laid in frequent contacts facilitated the FE.

This project was also similar to project "Army Brigade and Multi Service BF and Tasks" in terms of efforts to develop the assessment packages concurrently with the FA. Both projects benefited from that approach, since the review of the assessment packages was in effect part of the internal formative evaluation of the FAs. The efficiency of development efforts in this project would have been enhanced further by making the measurement specialists, supported by at least one non-development SME, responsible for developing the Tasks Organized by Outcomes component. This would have provided an early independent check on the degree to which the tasks being gathered from the doctrinal literature support the accomplishment of outcomes that lead to achieving the purpose of the BF.

While there are benefits to developing assessment packages concurrently with the FAs, the development schedule should be offset enough to enable the measurement specialists to incorporate all revisions. If the last review is significant, the assessment packages will have to be redeveloped. Even if the only changes are to details, the quality of assessment packages depends on the accuracy of those details. Specifically, there should be at least one month between the submission of draft FAs and draft assessment packages.

Inclusion of the User's Guide with the FAs ought to be continued in other similar projects.

A final lesson learned confirmed the vital contribution of the FE process (internal and external reviews) in the development of FAs. That contribution is discussed in the next section.

Formative Evaluation

Internal reviews of the coordinating drafts and subsequent refinements were a major component of the BF FA development methodology. At each stage, the internal reviews considered consistency with related analyses, completeness of outcomes identified, and doctrinal suitability of recommended TTP. In the first stage of the internal review, each draft was reviewed by one of the integrators. The integrator for the brigade reviewed the brigade HQ FAs and BF 18 for the CS and CSS battalions. The integrator for the battalions reviewed FAs for BF 19 and 20 related to the CS and CSS battalions and BF 16 for the ADA battery. That review was intended to ensure that the CS and CSS elements were horizontally integrated with each other and with the heavy battalion TF as well as vertically with brigade HQ BF 19 and 20. Following review by the integrators, the project manager, who was also the senior military expert, reviewed the FAs.

After the two-stage internal review process, components of the revised FAs were subjected to a series of external reviews. After each phase of the external review, the FAs were

revised in response to reviewer comments and recommendations. Each revision was reviewed internally as described above, except that the principal analyst for brigade BF 19 assumed responsibility for integrating the battalion/battery analyses of BF 19 and the brigade integrator took responsibility for the remaining BFs.

The external reviews were conducted in three phases:

- Review by CTC training teams
- Review by proponent agencies
- Review by Force XXI review council

The remainder of this section describes the procedures and results of each external review phase and presents lessons learned from the process.

Review by CTC Training Teams

The task lists for the brigade, supporting battalions, and ADA battery were reviewed at the NTC. Following revision based on the NTC review, the brigade task lists were reviewed at the Joint Readiness Training Center (JRTC).

NTC

All of the principal analysts visited the NTC at Fort Irwin, CA during May 1996. The visit included two types of activities. The first activity was to observe the last mission of a rotation while accompanying O/Cs in order to gain insights on the performance of the unit during a field exercise. The second activity was to review the task lists with O/C teams to determine the accuracy of the BF tasks and to identify new tasks and linkages between tasks based on current and emerging doctrine. This section summarizes results of review sessions with the O/Cs.

Brigade. Five members of the brigade training team (code-named Broncos) participated in the group review of BF 18, 19 and 20 as performed by the armored brigade: Senior Brigade Trainer, Brigade XO and Brigade Staff Trainer, Brigade S2/Intelligence Trainer, Brigade Army Airspace Command and Control (A2C2) Trainer, and Brigade Fire Support Trainer. While the review generally confirmed the accuracy of the task descriptions, discussions led to the following revisions:

- Designated the brigade S3/plans officer as responsible for dissemination of the division order.
- Modified the Preface component of the FA to indicate that tasks can be performed concurrently or in a sequence different from the order in the task list.
- Incorporated recommendations on scope and organization (by BOS) of commander's guidance.
- Revised supporting tasks to describe the minimum essential elements of information that a fragmentary order (FRAGO) should contain.

- Revised tasks supporting rehearsals to incorporate a commander's statement of purpose for rehearsals.

Two issues were not resolved during the group session. The first issue concerned the role of the brigade XO during planning. The NTC position was that the brigade S3 should be the primary planner because the brigade XO should be heavily involved in logistics matters. The BF FA described extensive XO involvement with planning because the brigade XO must be the staff coordinator and information manager during the preparation and execution phases of the battle.

The second issue that was not resolved during the sessions at NTC concerned the decision-making process under time-constrained conditions. The O/Cs contended that the deliberate, quick, and combat decision-making processes apply to corps and division echelons and must be redefined for battalion and brigade levels. The O/Cs recommended a process where the course of action (COA) development phase results in a draft plan, which is then synchronized during war gaming. The FAs, based on FM 101-5, reflected a process where the war gaming phase is used to select a COA, with specific options for the quick and combat variations. Since the NTC approach was not yet documented, it was not incorporated into the BF FAs. Subsequent to the review at NTC, the Commanding General (CG), Combined Arms Command (CAC) directed that FM 101-5 be revised in regard to the decision-making process. He directed that there would be one decision-making process, termed the MDMP. All steps of the MDMP must be performed but the commander has options based on time constraints. The quick and combat processes, as well as the NTC recommendation, are considered as ways to adapt the process. The BF FAs were then revised to be consistent with the decision made by CG, CAC.

Air defense battery. Three members of the Bronco Training Team participated in the review of BF 16--Take Active Air Defense Measures: Brigade Air Defense Trainer/ADA Battery Trainer (both outgoing and incoming) and the Brigade Air Defense Senior NCO Trainer. All issues raised in the review of BF 16 were resolved during the group session. The resulting modifications were:

- Expanded discussion of the air defense liaison officer's role in issuing the warning order (WARNO), assistance to the S2 during intelligence preparation of the battlefield (IPB) development, and development of the brigade WARNO.
- Added supporting tasks associated with enemy prisoner of war processing.
- Revised tasks to cover the ADA battery commander's integration of brigade direct and indirect fire weapons with the air defense plan.
- Added discussion of the need to include the purpose of subordinate unit tasks in the execution paragraph of the brigade air defense annex.

DS field artillery battalion. The Field Artillery Training Team (code-named Werewolves) provided eight trainers for the group session that addressed BFs 18, 19, and 20 as performed by the DS field artillery battalion: Field Artillery Battalion Senior Trainer, Field Artillery Battalion S3 Trainer, Field Artillery Battalion Assistant S3/Fire Direction Center Trainer, Field Artillery Battalion S2 Trainer, Field Artillery Battalion Assistant S3 Trainer, Field Artillery Battalion CSS

Trainer, and two Field Artillery Battery Trainers. As with the review of the air defense FA, all issues raised were resolved within the group session. The revisions are summarized below:

- Revised treatment of the modified combined obstacle overlay to delete the requirement for range to target information and to include enemy reconnaissance avenues of approach.
- Clarified staff support of the DS field artillery battalion S3's development of the position area overlay.
- Revised tasks to increase emphasis on total staff integration in development of the IPB and analysis to support accurate predicted fires.
- Revised supporting tasks to include dissemination of no fire areas for Combat Observation Lasing Team (COLT) and other FA observers.

Engineer battalion. Seven O/Cs from the Engineer Training Team (Sidewinders) reviewed BFs 18, 19, and 20 as performed by the engineer battalion: Engineer Battalion Senior Trainer, Engineer Battalion XO and Staff Trainer, Engineer Battalion S3 Trainer, Assistant Brigade Engineer Trainer, Engineer Battalion CSS Trainer, Engineer Battalion S3/Operations Trainer, and Engineer Battalion S2 Trainer. Discussions among the BF analysts and the Sidewinders resulted in the revisions summarized below:

- Revised supporting tasks to provide latitude in the identification of an FSB staff engineer [NTC preference was for the headquarters and headquarters company (HHC) commander; BF 18 tasks identified either the engineer battalion S1 or S4].
- Added supporting tasks to describe staff/CP actions to obtain copies of the division OPORD.
- Clarified engineer battalion commander's role as brigade engineer during brigade mission analysis.
- Refined supporting tasks concerning the engineer battlefield assessment (EBA) to reflect the S3 as proponent for the EBA, with the engineer battalion S2 preparing pertinent parts of the EBA and coordinating with the brigade S2 to confirm or refine baseline data.
- Added supporting tasks to describe the engineer battalion commander's participation in maneuver battalion TF rehearsals and the first sergeant's participation in logistics rehearsals.
- Revised tasks in execution to include coordination of weapons system replacement operations for engineer-unique equipment.

Two issues were not resolved during the group sessions. The first issue concerned whether the engineer battalion needed to conduct an engineer-specific decision-making process if the engineer battalion's subordinate companies have been task organized to the maneuver battalion TFs. The NTC position was that, under those conditions, the engineer battalion should conduct implementation planning to synchronize engineer operations after the brigade COA and engineer scheme of engineer operations decisions. The FAs kept the procedures based on published doctrine. The second unresolved issue concerned the officer in charge of the engineer

battalion rear CP. The Sidewinders recommended the engineer battalion S1 or S4. The FAs, consistent with published doctrine, specify the HHC commander.

Forward support battalion. The following nine members of the FSB Training Team (Goldminers) reviewed the task lists for BF 18, 19, and 20 as performed by an FSB: FSB Senior Trainer, FSB XO and Staff Trainer, FSB Support Operations Trainer, FSB S2/3 Trainer, FSB Maintenance Trainer, FSB HHD Trainer, FSB Supply Company Trainer, FSB Maintenance Company Trainer, and FSB Medical Company Trainer. All of the issues raised in the discussions with the Goldminers were resolved. The recommendations and subsequent discussions led to the following revisions:

- Revised supporting tasks to describe the brigade surgeon's participation in the brigade's planning process, given the requirements for the FSB medical company commander (who is specified as the brigade surgeon) to be away from the brigade main CP for much of the time.
- Revised supporting tasks to describe the participation of the brigade S4 liaison officers in the brigade's planning process.
- Revised BF 18 Preface to explain that the S2/3 intelligence section was expected to perform only those planning tasks designated by the commander based on mission, enemy, friendly troops, terrain, and time (METT-T).
- Revised supporting tasks to describe the FSB commander's identification of friendly forces information requirements and essential elements of friendly information.
- Deleted references to location of the FSB support operations officer and clarified the need for the support operations officer to coordinate with the brigade S4.
- Added critical fire zones to the list of artillery considerations for war gaming.
- Revised supporting tasks to include development of fire control measures to protect the brigade support area perimeter and to ensure fratricide avoidance.

Joint Readiness Training Center

During July 1996, the principal brigade analysts and the project director conducted a review session of the brigade-level analyses with the following 13 trainers and staff members at the JRTC: Deputy Chief, Operations Group, JRTC; Operations Group S3; Brigade Command and Control XO; Senior Intelligence O/C; Infantry Battalion Coach; TF 1 O/C; JRTC-CALL Representative; Chief, Leader Training Program (LTP); LTP Brigade Coach; LTP Janus Coach; LTP Fire Support Coach; and two LTP Coaches.

The discussions were directed first at informing the JRTC leadership of the status of BF work and identifying how the analyses might affect the JRTC. In addition, the analysts sought feedback on the task lists, with particular emphasis on differences between light and heavy brigade operations. The discussion resulted in increased emphasis on targeting and greater latitude in regard to products (e.g., decision support template and operations schedule) that are prepared and updated. The reviewers concluded that the processes and major tasks applied to both heavy and light brigades. Differences noted were at the level of TTP based on battle space conditions.

Review by Proponent Agencies

After the task lists were revised based on reviews at the CTCs, FA components were mailed to the proponent agencies by the ARI Armored Forces Research Unit (AFRU) at Fort Knox. At the same time, the revised task lists were resubmitted to the CTC training teams. The guidance for the proponent review (and the second review by CTC trainers) asked for review of the following components: Preface, Purpose and Outcomes, Task List, Flow Charts, Gate Tasks, and References.

Brigade

The brigade FAs were reviewed by staff members of the NTC, JRTC, Battle Command Training Program, and Command and General Staff College. The comments from NTC were negative, but too general to support revisions (e.g., rewrite document as a TTP manual). Comments from the other agencies resulted in extensive revisions for increased precision. The major revisions are summarized below:

- Changed several terms: “heavy brigade” instead of “brigade combat team” (which was later changed to “armored brigade”); “mortuary affairs operations” instead of “graves registration services”; “updated estimate” instead of “running estimate.”
- Revised discussion of decision-making to be consistent with the August 96 edition of FM 101-5, reflecting one decision-making process--the military decision-making process--that can be done in a time constrained environment. Previous discussions described deliberate, combat, and quick decision-making processes.
- Revised reconnaissance and surveillance (R&S) tasks to describe a procedure that initiates R&S operations before the initial WARNO.
- Expanded treatment of the XO’s role in the brigade tactical operations center.
- Added supporting tasks to cover the concept of using the S5 to discover ways to exploit civilian resources to assist the brigade’s operation.

Air Defense Artillery Battery

The BF 16 FA was reviewed by the NTC Bronco Training Team and U.S. Army Air Defense Artillery School (USAADAS). The Bronco review confirmed that recommendations had been incorporated. The comments from USAADAS concerned the accuracy of page references (because of impending revisions to FM 44-8) and terminology within lessons learned.

Direct Support Field Artillery Battalion

The FAs for BFs 18, 19, and 20 as performed by the DS field artillery battalion were reviewed by the NTC Werewolves Training Team and the U.S. Army Field Artillery School (USAFAS). The NTC reviewers concurred that the analyses adequately addressed the planning, preparation, and execution tasks that needed to be accomplished. The reviewers at USAFAS made a variety of recommendations to clarify procedures. Two major changes were made based on their comments:

- The number of nets to be monitored was limited to one digital and two voice nets.
- All references to “tactical fire direction system” were replaced with “improved fire support automated system/advance field artillery tactical data system.”

In addition, USAFAS staff provided a very thorough review of task numbers and other reference data for the Task List and Gate Tasks components.

Engineer Battalion

The NTC Sidewinders Training Team and the U.S. Army Engineer School (USAES) reviewed the revised FAs for BFs 18, 19 and 20 as performed by an engineer battalion. The USAES comments concerned projected changes to the engineer force structure for Force XXI. As a result, a disclaimer statement was added to the Preface that future force structure and doctrine are not addressed in the task analysis. The Sidewinders’ comments resulted in the following revisions:

- Supporting tasks on time analysis were revised to include rehearsal times for the maneuver battalion TFs.
- The scope of METT-T assessment was broadened to include the status of all mobility assets including mine plows and rollers.
- Supporting tasks for the logistic estimate were revised to include Class VIII medical material.
- The scope of information to be tracked by the engineer battalion S2 was extended to include specific obstacle criteria and status of friendly reconnaissance assets.
- References to the “Mobility/Counter mobility/Survivability” BOS were changed to “Mobility/Survivability.”
- Supporting tasks on emergency resupply were revised to include marking material.

- Discussion of the battalion maintenance officer's acquisition of information was expanded to include unit collection maintenance points and recovery assets of maneuver TFs.

Forward Support Battalion

The command and control BFs as performed by the FSB were reviewed by the NTC Goldminers Training Team and by the U.S. Army Combined Arms Support Command (CASCOM). The Goldminers recommended increased discussion of the use of the HHC slice commanders in development of the BOS annexes to the FSB Operation Order (OPORD). That recommendation was implemented. CASCOM concurred with the analyses as written.

Review by Force XXI Review Council

In September 1996, the CG, U.S. Army Armor Center (USAARMC) hosted a panel review of the BF analyses reflecting revisions based on the proponent reviews. The rank and organization of members of the Review Council are shown in Table 10.

Table 10

Review Council Members

Rank	Organization
COL	Director, Directorate of Training and Doctrine Development (DTDD), USAARMC, Ft Knox, KY
LTC	Chief, Force XXI Training Program, USAARMC, Ft Knox, KY
LTC	Chief, Army Training XXI, USAFAS, Ft Sill, OK
LTC	NTC, Operations Group, Ft Irwin, CA
COL	TRADOC Program Integration Office (TPIO)-Army Battle Command System, Ft Leavenworth, KS
LTC	HQ U.S. Army Armor School, Ft Knox, KY
COL	Commander, 29th Infantry, Ft Benning, GA
LTC	Director, Combined Arms Tactics and Doctrine, USAADAS, Ft Bliss, TX
LTC	Chief, LTP, JRTC, Ft Polk, LA
COL	Directorate of Training, USAES, Ft Leonard Wood, MO

The CG, USAARMC and Fort Knox established the broad context. He described the benefits to be derived from task-based training associated with functions. He characterized the identification of tasks to train and interrelationships shown in the BF FAs as vital in developing training tools, e.g., help develop MTPs--not replace MTPs. Finally, he set two goals for the review council: gain a better understanding of the FAs, especially by people from agencies other than USAARMC; and obtain accurate input into the final documentation.

After orientation briefings covering the scope of the BF FAs, the council considered the components of the brigade HQ FAs in detail. The components of interest were the Purpose and Outcomes, Flow Charts, Task List, and Key Participants. The review was done by BF.

BF 18

The council first considered the Purpose and Outcomes. Two outcomes were revised to clarify that planning should consume no more than 1/3 of the available time and to make explicit that the identification of key personnel and the distribution of products were to be in accordance with TSOP. The review of the Flow Chart revealed duplication of a task concerning attendance at the division rehearsal and some confusion concerning whether the tasks were sequential. The review of Key Participants identified supporting personnel to be added for mission analysis.

The remainder of the review of the BF 18 FA concerned the Task List. The principal analyst described the scope of each task and solicited comments concerning the accuracy and completeness of the task and supporting tasks. Council members discussed the comments until they reached a consensus on any changes. The major recommendations (all of which were implemented) are described below:

- Clarify responsibilities of the S3 and XO. For example, the S3 is responsible for conduct of brigade reconnaissance, while the XO is responsible for integrating staff inputs and is the primary terrain manager.
- Identify specific points for issuance of WARNOs; include a sequence of three WARNOs.
- Refine treatment of mental stress assessment.
- Expand treatment of the targeting team and Army Airspace Command and Control (A2C2).
- Add a supporting task that presents a list of the minimum products developed.

BF 19

The same approach was applied to the review of the BF 19 FA. The council recommended that the Purpose be revised to include accomplishing the corps commander's intent (as well as the division commander's intent). The Outcome related to timeliness of distribution of orders was revised to include time for affected units and personnel to execute actions required. No changes were recommended for the Key Participants or Flow Charts components. Major recommendations follow:

- Clarify that the identification and role of the battle captain are governed by TSOP.
- Add convening of the targeting team and A2C2 cell to XO responsibilities.
- Add identification of changes to METT-T that should lead to convening the targeting team or A2C2 cell to the responsibilities of members and supporting sections.
- Clarify that the commander may combine rehearsal techniques.

BF 20

As with BF 19, the council recommended adding the corps commander's intent to the Purpose. The council also identified a reference to deliberate decision-making in the Flow Chart; the statement was revised to be consonant with the MDMP. No recommendations were made concerning the Outcomes or Key Participants. Several recommendations for the Task Lists in the FAs for BFs 18 and 19 were also applied to BF 20. Additional recommendations are shown below:

- Revise tasks and supporting tasks to reflect that the commander “sees” the current battlefield and “visualizes” projected states.
- Revise the treatment of the decision-making process to emphasize modifications to produce the FRAGO rather than selecting a process.
- Revise supporting tasks covering the loss of the main CP so that the CP designated in TSOP (not necessarily the rear CP) is specified to assume main CP responsibilities.
- Revise supporting tasks on the succession of command to clarify the procedures if the XO is not the designated commander.

Supporting Battalion/Battery BF FAs

As each brigade level BF FA was reviewed, analysts for the supporting battalions and battery incorporated the guidance that also applied to their analyses. In addition, those analysts met with council members who represented agencies that have proponentcy for the supporting battalions and battery. (The USAES sent a member of the Doctrine Development Department to provide a more detailed review.) For all battalions and batteries represented, the analysts described how previous recommendations had been implemented and addressed remaining issues. The discussions resulted in further refinement of the brigade FAs as well as specific recommendations for the battalion/battery FAs.

Lessons Learned Regarding Formative Evaluation

Review of the auxiliary materials, especially the assessment packages, provided an additional level to the internal FE. As described in the section on Development Methodology, the development of measures oriented on outcomes constitutes a check on completeness of the FA. The coordinated development strategy, modified as described in that section, ought to be implemented in future projects.

The reviews by CTC trainers and by proponent agencies have been a part of the FE process for all previous BF development projects. The demonstrated benefits of those reviews continued in this project. These reviews were facilitated in the current project by the sponsorship of the Force XXI Training Program. The coordination between AFRU and Force XXI enabled review by TRADOC proponents and the CTCs.

This project was the first time that FA products were subjected to review by a group of senior officers assembled from the proponents and the CTCs. The benefits of the review council

phase exceeded expectations. The council members representing TRADOC's Force XXI Training Program provided an extensive systematic review of integration within the armored brigade. The experts generally validated the description of integration; the variety of perspectives and the synergy of the discussion were invaluable. In addition, the format gave visibility to the FAs. Feedback on potential applications (discussed later in this report) will facilitate plans by Force XXI and by ARI for future development and implementation efforts. While the difficulties of impaneling experts for the time required are acknowledged, every effort should be made to incorporate a comparable review for all similar projects.

Discussion

The development and formative evaluation efforts described in this report resulted in products that have significant potential for practical applications. This section describes applications of the BF FAs and discusses directions for future research.

Applications

The BF FAs developed in this project were intended to be applied in three ways:

- Support development of staff training modules within the ITTBBSST program.
- Support unit training.
- Support training developers within TRADOC.

This subsection describes how the materials can be applied in each of those contexts.

Support Development Of Staff Training Modules Within the ITTBBSST Program

In parallel with the BF FA project, staff training modules were developed in the BSTS and SGT projects. The schedule for BF FA development was structured to make initial FAs available to support the front-end analyses of those projects. In addition, the BSTS Team provided information related to prerequisite skills to the BF Team.

Because the project's technical objective called for an emphasis on staff training, analysts sought to ensure that the FAs would be appropriate not only for a field training exercise that covers all personnel and units, but also for a staff exercise that involves a subset of personnel. Two characteristics of the BF FAs were key for that flexibility.

- The FA structure provides explicit linkages. Each BF FA includes a section that specifies the people and units who participate in each task. In addition, a flow chart illustrates the relationships among people and units during each battle phase. The linkages apply within the echelon and with higher and lower command echelons. Such linkages identify combinations of staff members to include or simulate in a staff exercise scenario.

- Each FA specifies information the unit requires for task accomplishment and information that must be developed to accomplish the task (Key Inputs and Outputs). The input identifies information that must be provided to staff members during the staff exercise; the output facilitates assessment by identifying interim and final products of the function. Input-output information is especially important for staff training of the CS and CSS battalions since they receive guidance and information from their chain of command and from the armored brigade and provide information necessary for operations of the armored brigade and for the CS and CSS battalions' subordinate units.

Support Unit Training

As discussed in the subsections Evolution of FA Components and Development of the User's Guide, the support of unit training is the primary purpose of the series of BF analysis projects. This discussion is included to amplify material in the user's guide subsection about how unit trainers might apply the FA components.

During the assessment phase of the unit training cycle, the commander (battalion or brigade) assesses the unit's training readiness by METL task, BOS, BF, and outcome. Subordinate commanders complete a similar assessment of their units. All commanders base their assessments on their observations as well as on observer evaluations from exercises in a local training area, at a CTC, or in a battlefield simulation. They will also solicit input from officers and NCOs with expertise related to the BF--for example, the S3 Air and Air Defense Liaison Officer would be able to provide insight into the unit's effectiveness related to active air defense measures. The commander then coordinates with the subordinate commanders to identify training emphases, typically by outcome.

The staff develops the short-range training plan based on the commander's training assessment and resulting guidance. Staff members with expertise in the BF make initial recommendations to the S3 on a strategy to address the needs identified in the commander's guidance. The BF FAs help staff members identify the tasks related to the outcome to be trained (Tasks Organized by Outcomes), identify participants in exercises to train the tasks (Key Participants), and determine the start stage of training (Gate Tasks). The assessment strategy in the assessment packages helps the staff design specific events that cover the tasks in each outcome. The S3 then consolidates the events/exercises recommended by the staff and identifies prerequisite training to be addressed by subordinate units.

When the training is conducted, the assessment packages help observers focus on key parts of the events and provide feedback by BF and outcome. In most cases, the observers can diagnose performance to recommend specific tasks to sustain or remediate. The assessment from those observations then feeds back to the commander as the basis for further training.

Support Training Developers Within TRADOC

The TRADOC training developers constitute one of the audiences addressed in the User's Guide. The guidance included in that document is summarized in Development Methodology. The members of the review council also addressed the issue of application. Following the review of BF FA components, the Director of DTDD, USAARMC led a discussion of potential applications. The responses to his poll of representatives of each agency on how they envisioned implementing the products are summarized below by agency.

U.S. Army Field Artillery School. Within the "school house" the materials would assist in developing the program of instruction, addressing integration within the pre-command and officer advanced courses, and developing practical exercises with simulations. If the information were in a readily accessible digital format, the task analyses would be very useful front end analysis tools in development of training support packages. In their current format, the documents support materiel development (e.g., functionality check on whether command and control systems can handle the types of traffic required for synchronized operations), justify positions for force development, and identify holes to be filled in doctrine development.

U.S. Army Infantry School (Represented by Commander, 29th Infantry). In their current format, the materials have low utility for training support development. They are applicable for materiel development, doctrine development, and revising force structure. Similar materials addressing JTF operations would have great utility.

U.S. Army Engineer School. Materials in their current form are a great starting point for training development in the officer's advanced course and the pre-command course-- "they could be used today." The materials also have immediate value in articulating the role of the engineer battalion for force development work.

TRADOC Program Integration Office--Army Battle Command System. The FA products would support development of the Army Battle Command System by supporting decisions on establishing priorities. The analyses also support the pre-command course and doctrine development. The Warfighters Simulation (WARSIM) developers have described the brigade Command and Control BF FAs as the best analyses they have seen.

National Training Center. Utility of the materials for O/C use would be limited, since the FAs do not (now) have doctrinal standing. Materials could help with teaching O/Cs, especially O/Cs for staff officers. Materials would also be a useful basis for checking unit TSOPs.

Joint Readiness Training Center. Because of the orientation on heavy operations, the BF analyses are not highly applicable to the JRTC. The potential value to the Army is apparent, especially if the analyses are put in a digital format.

U.S. Army Air Defense Artillery School. (Comments were made outside of the council session.) As they are, the materials would be very valuable for officers at USAADAS prior to field assignments as well as in the field for battalion commanders. A comparable level of detail

incorporated for the previous battalion TF FAs of the Air Defense BFs would be valuable (since air defense units fight as small units).

Future Directions

The members of the review council also addressed the issue of future research. The council host asked council members to identify their top priority among four options: do nothing, continue brigade development, upgrade previous battalion TF BF analyses, and revise current analyses and databases for increased digital access. All respondents recommended further research. These options, plus the option of extending to other type units, are described below.

Continue Brigade Development

Three of the six council members who were polled (Engineer, TPIO, and NTC representatives) selected this as their primary option. After the poll, the council host presented his perspective on priorities among the remaining 12 BFs. Discussion of those priorities among project staff led to the identification of the following six BFs as the highest priorities in the context of the armored brigade and supporting units:

1. Engage Enemy with Direct Fire and Maneuver (BF 6)
2. Conduct Tactical Movement (BF 5)
3. Provide Counter-Mobility (BF 23)
4. Conduct Enemy Prisoner of War Operations (BF 34)
5. Enhance Physical Protection (BF 24)
6. Provide Operations Security (BF 25)

Upgrade Previous Battalion Task Force BF Analyses

None of the council members present in the last session selected this option. But it is unlikely that any of them had seen the battalion TF FAs. The USAADAS representative had seen the parallel battalion TF FAs and recommended revising them to the same level of detail as the brigade level analyses. As described in Rationale for BF Components, the quality of analyses in this project is substantially improved over the battalion TF analyses. Upgrading the analyses should be considered.

Extend Analyses to Other Types of Units

Although this was not an option in the council host's poll, the comments clearly identify it as a high priority from the perspective of the JRTC representative. The specific recommendation is to conduct similar analyses for light units.

Revise Analyses for Increased Digital Access

Three council members--Field Artillery, Infantry, and JRTC representatives--selected the option for increased digital access. Based in part on their recommendation, ARI is conducting research to explore that option. The objective of that research is to automate the BF FAs in a relational database format for stand-alone access and for integration into the Army-wide Automated Systems Approach to Training (ASAT). The results of this work may be limited by the current ASAT software, which requires a high level of computer-related expertise to format and subsequently extract information contained in the present paper-based FAs (McIlroy, in press). That level of expertise is probably more likely among TRADOC training developers than among unit commanders.

The exploratory research on automation of FAs includes the following steps:

- Create a relational database design which will support the FAs and be compatible with ASAT requirements.
- Devise methods for converting text and graphics into the relational database structure.
- Execute the conversion process to create a relational database containing the BF FA data.
- Design a graphical user interface (browser) application that allows users to review all levels of BF FAs.
- Develop browser screens and associated software.
- Design the method for converting data in the BF relational database to ASAT.

This work is projected to be complete in April 1997.

Summary

This project applied the procedures from other research projects that described synchronization of combined arms operations. The analysts for the work described in this report benefited from improvements from those projects and, in turn, enhanced the effectiveness of the procedures. Probably the most important advance in the procedures was the incorporation of the detailed expert review conducted by the review council. That the Army made officers available who had the council members' levels of experience and expertise indicates the high expectations for the FAs. It is noteworthy that after the sometimes grueling reviews, all members of the council recommended extending the research efforts. One clear conclusion from this project is that the BF FAs address a pressing need. The Army stands to benefit from capitalizing on the momentum generated by this project and extending the analysis to other functions, echelons, and unit types.

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APPENDIX A

Acronyms and Abbreviations

A2C2	Army Airspace Command and Control
AAR	After-Action Review
ACOR	Assistant Contracting Officer's Representative
ADA	Air Defense Artillery
AFRU	Armored Forces Research Unit
ARI	U.S. Army Research Institute for the Behavioral and Social Sciences
ARTEP	Army Training and Evaluation Program
ASAT	Automated Systems Approach to Training
BF	Battlefield Function
BOS	Battlefield Operating System
BSTS	Battle Staff Training System
CAC	Combined Arms Command
CALL	Center for Army Lessons Learned
CASCOM	Combined Arms Support Command
CATS	Combined Arms Training Strategy
CCF	Critical Combat Function
CG	Commanding General
COA	Course of Action
COBRAS	Combined Arms Operations at Brigade Level, Realistically Achieved Through Simulation
COL	Colonel
COLT	Combat Observation Lasing Team
CONUS	Continental United States
COR	Contracting Officer's Representative
CP	Command Post
CS	Combat Support (e.g., field artillery battalion, engineer battalion, and air defense artillery battery)
CSS	Combat Service Support (e.g., forward support battalion)
CTC	Combat Training Center
DS	Direct Support
DTDD	Directorate of Training and Doctrine Development
EBA	Engineer Battlefield Assessment
FA	Function Analysis
FE	Formative Evaluation
FM	Field Manual
FRAGO	Fragmentary Order
FSB	Forward Support Battalion
HHC	Headquarters and Headquarters Company
HQ	Headquarters
IPB	Intelligence Preparation of the Battlefield

ITTBBST	Innovative Tools and Techniques for Brigade and Below Staff Training
JRTC	Joint Readiness Training Center
JTF	Joint Task Force
LTC	Lieutenant Colonel
LTP	Leader Training Program
MDMP	Military Decision Making Process
METL	Mission Essential Task List
METT-T	Mission, Enemy, Friendly Troops, Terrain, and Time
MTP	Mission Training Plan
NBC	Nuclear, Biological, Chemical
NCO	Noncommissioned Officer
NTC	National Training Center
O/C	Observer/Controller
OPORD	Operation Order
PSYOP	Psychological Operations
R&S	Reconnaissance and Surveillance
S1	Personnel Officer (battalion or brigade staff)
S2	Intelligence Officer (battalion or brigade staff)
S3	Operations and Training Officer (battalion or brigade staff)
S4	Logistics Officer (battalion or brigade staff)
S5	Civil Affairs (battalion or brigade staff)
SGT	Staff Group Trainer
SME	Subject Matter Expert
TF	Task Force
TO&E	Table of Organization and Equipment
TPIO	TRADOC Program Integration Office
TRADOC	U.S. Army Training and Doctrine Command
TSOP	Tactical Standing Operating Procedures
TTP	Tactics, Techniques, and Procedures
USAADAS	U.S. Army Air Defense Artillery School
USAARMC	U.S. Army Armor Center
USAES	U.S. Army Engineer School
USAEUR	U.S. Army Europe
USAFAS	U.S. Army Field Artillery School
WARNO	Warning Order
WARSIM	Warfighters Simulation
XO	Executive Officer